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SURVEY REPORT FOR THE CHARACTERIZATION OF RADIOLOGICAL CONTAMINATION OF THE CSX TRANSPORTATION GROUP RAILROAD TRACKS OAK RIDGE, TENNESSEE

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Publicly Releasable

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LIST OF ACRONYMS

Cs-137	cesium-137
DOE	Department of Energy
ESD	Environmental Sciences Division
HASRD	Health and Safety Research Division
HOG	highest outdoor gamma
LLRA	low level radiochemical analysis
MMES	Martin Marietta Energy Systems
NRC	Nuclear Regulatory Commission
ORAU	Oak Ridge Associated Universities
ORNL	Oak Ridge National Laboratory
PAG	Pollutant Assessment Group
PIC	pressurized ionization chamber
QA	quality assurance
QC	quality control
RASA	Radiological Survey Activities Group
RI/FS	Remedial Investigation/Feasibility Study
Sr-90	strontium-90

EXECUTIVE SUMMARY

This document serves as the preliminary radiological characterization for the CSX Transportation Group railroad tracks in Oak Ridge, Tennessee. This report was prepared by the Oak Ridge National Laboratory's Pollutant Assessment Group (ORNL/PAG), Grand Junction, Colorado, in conjunction with the Environmental Sciences Division (ESD) of ORNL. The results from this report are a combination of previous reports and surveys conducted March 6 to 13, 1990 and June 26 to 29, 1990 by the ORNL/PAG.

The objectives of this survey report are to assess and characterize the extent of radiological contamination in the CSX Transportation Group railroad tracks between Bear Creek Road and Elza Gate within Oak Ridge, Tennessee. The survey report will provide information necessary to prepare a Preliminary Assessment (PA) that will determine if a Remedial Investigation/Feasibility Study (RI/FS) is warranted.

The survey was conducted in a northeasterly direction away from the Oak Ridge Y-12 Plant. Several residential neighborhoods were located along the CSX railroad tracks. The survey included all track ballast and extended a minimum of five m (16 ft) beyond each side of track. The survey procedures included: establishing a 100 m grid along the track centerline; conducting a complete walkover gamma radiation scan; delineating deposits; sampling the soil/ballast material; conducting a complete gamma spectral analysis; and analyzing for total uranium, gross alpha, gross beta, and strontium-90 in ballast material.

As an addendum to the CSX work plan, three vicinity properties within close proximity to the railroad contamination were scanned for elevated gamma exposure rates. No elevated readings were encountered during these surveys.

Ten regions of elevated gamma exposure rates above the general background of 5 to 9 μR/h were located along the CSX railroad tracks. These regions ranged from 10 to 850 μR/h at the surface and 7 to 75 μR/h at one meter above the surface. Three additional areas of elevated gamma exposure rates were located and attributed to gamma emanation fields associated with the Quadrex Corp. Plant and to radiation inherent to the natural material within the ballast.

The preliminary assessment demonstrates that cesium-137 is the primary contaminant of concern. The Department of Energy (DOE) has not established a specific guideline for Cs-137 contamination in soils for unrestricted areas; however, the Nuclear Regulatory Commission (NRC) has used a guidance level of 17 pCi/g for sites being released from licensing controls. The estimated volume of material exceeding this guideline is 47 m^3.

Due to the lack of chemical evaluations and possibility of contaminant migration, further investigations in the form of an Remedial Investigation and Feasibility Study (RI/FS) is recommended.

1.0 INTRODUCTION

A radiological and chemical surface characterization survey of the Oak Ridge Y-12 Plant was conducted in early 1986 by the Radiological Survey Activities Group (RASA) of the Health and Safety Research Division (HASRD) of Oak Ridge National Laboratory (ORNL). During this survey, cesium-137 (Cs-137) contamination was identified in several locations at the east end of the Y-12 Plant. Localized areas of contamination were found along both sets of the CSX Transportation Group railroad tracks west of Scarboro Road near the eastern perimeter of the Y-12 Plant. At the request of Y-12 management, a preliminary survey for radionuclide contamination was also conducted by RASA personnel along the CSX railroad spur east of Scarboro Road [Plate 1, (Fig. 1)]. Additional areas of contamination were located along this spur which is easily accessible to the general public (Foley 1986).

To further delineate the extent, levels, and type of radiological contamination in the areas east and west of Scarboro Road, a follow-up study was commissioned by the Department of Energy (DOE) and was conducted by the Radiological Site Assessment Group of Oak Ridge Associated Universities (ORAU) in November 1986 with a report issued to the Department of Energy (DOE) in February, 1987 (ORAU 1987). The ORAU survey further delineated the areas and concentrations of Cs-137 contamination in the railroad ballast east and west of Scarboro Road. Because the extent of the Cs-137 contamination was uncertain, a complete radiological characterization of the CSX Transportation Group railroad tracks in Oak Ridge was needed. Therefore, a work plan was developed (Appendix A) in March, 1989, tasking the ORNL/Pollutant Assessment Group (PAG) to survey the 11.2 km (7 mi.) of track between Bear Creek Road and Elza Gate [Plate 1, (Figs. 1-5)]. Between March 6 to 13, 1990 and June 26 to 29, 1990, a preliminary radiological characterization of the CSX Railroad tracks was conducted by ORNL/PAG. The procedures and findings of that survey are presented in this report.

2.0 SITE DESCRIPTION

The survey began approximately 30 m (98 ft) north of the intersection of Bear Creek Road and Scarboro Road [Plate 1, (Fig. 1)]. The survey proceeded along the CSX

tracks in a northeasterly direction away from the Y-12 Plant and terminated at Elza Gate near the eastern edge of Oak Ridge as outlined in the work plan (Appendix A). The tracks follow Scarboro, Lafayette, Fairbanks, and Warehouse Roads, respectively. Residential properties are located along the CSX property lines at several locations. Several homes are located 15 m (49 ft) to the south of placards 1900 through 2500 [Plate 1, (Figs. 2 and 3)]. Residential neighborhoods are also located to the south of Fairbanks and portions of Warehouse Roads. Area businesses are located along the sidings within the switch yard area on Warehouse Road. All other areas within this survey are predominantly undisturbed land. Public access to the tracks within these areas is unrestricted.

The survey included all track ballast and extended a minimum of five m (16 ft) on each side of the tracks. All railroad sidings were surveyed approximately 100 m (328 ft) beyond the intersection with the main tracks. The main switch yard contained multiple sidings that were labeled alphabetically and surveyed as described within the procedure survey section (see Section 3). Areas within the CSX railroad boundary with unusual characteristics (i.e., piles of dirt, old rail beds, and dissimilar ballast) were also surveyed. All data collected from this and prior surveys will determine whether or not there is compliance with federal and/or state regulations and will be used to assess the magnitude and immediacy of risk from the contamination. Recommendations for further actions will be made based on these findings and included in the final report to DOE.

3.0 PROCEDURES

1. For survey and sampling reference, a 100-m (328-ft) grid was established along the centerline of each section of track. Every 100-m section of track was labeled with a circular aluminum placard. The grid origin and corresponding 100-m increments are shown on Plate 1 (Fig. 1 through 5). All survey activities were recorded relative to these grid markers.

2. A complete walkover gamma screening was performed using methods outlined in the **ORNL/PAG Procedures Manual** (Little et al. 1990). Measurements were taken with

Victoreen Thyac III portable gamma scintillometers. Areas with elevated gamma measurements above the general background range of 5 to 9 μR/h were marked for further investigation.

3. Exposure rates were measured at the surface and at one meter above the surface. The exposure rates were then entered on the corresponding gamma screening sheets (Appendix B). The conversions of the exposure rates from kcpm to μR/h was determined by on-site cross calibration of the portable rate meter with a pressurized ionization chamber (PIC). This information was utilized to construct a correlation curve as shown in Figure 1.

The conversion formula is:

$$y = mx + b$$

Where: y = exposure rate (μR/h),
m = slope of line (μR/h per kcpm),
x = scintillometer measurement in (kcpm),
b = intercept (μR/h),

or:

$$y = 1.06x + 2.85.$$

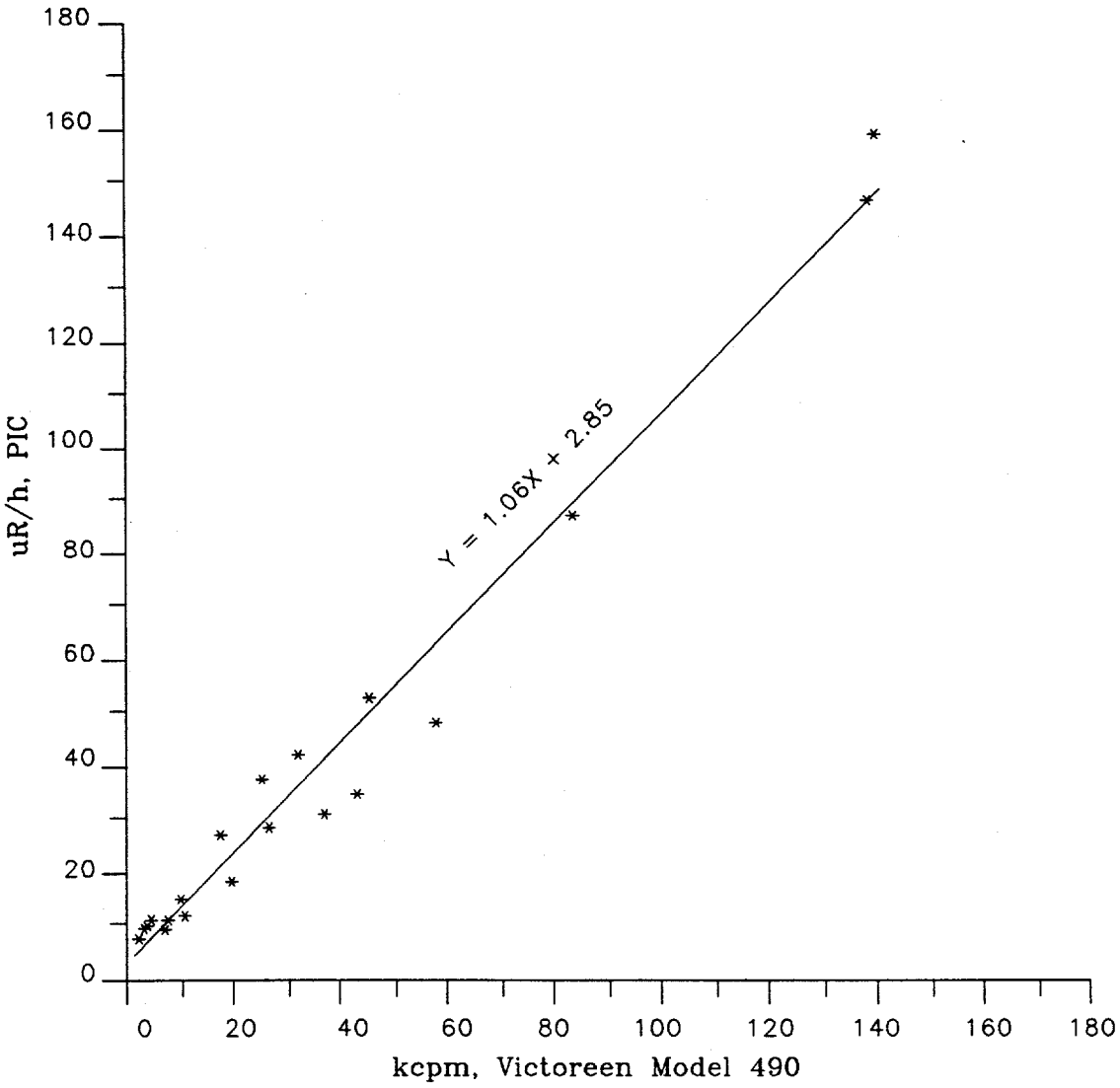

Fig. 1. Gamma correlation curve

4. After completion of the walkover gamma scan, areas with elevated gamma exposure rates above the general background were delineated and sampled accordingly. Samples were taken from contaminated regions that were representative of the surrounding deposits with similar exposure rate ranges. Some deposits were not sampled since the size or location of the contamination made sampling infeasible (i.e., railroad tie involvement and/or sampling areas < 2 m^2 in size). Several larger regions were sampled at the highest outdoor gamma (HOG) and the next highest gamma within 2 m of the HOG. These samples provide a conservative estimate of the mean concentration of the radioactivity associated with the deposit. Soil sample depth was dependent on the gamma readings. A gamma scintillometer measurement was taken on the surface and recorded. Another gamma reading was taken at each subsequent depth after a sample was taken. If gamma measurements increased by more than 20% (a maximum of 20% increase is due to the effect of geometry in the hole on the probe), sampling at subsequent depths was continued until readings stabilized or decreased (Little et al. 1990). Additional soil samples were collected to meet QA/QC procedure requirements. In addition, chain-of-custody forms and custody seals were used during sample collection and transport.

5. The following radiological analyses were performed on the soil/ballast samples by the Low-Level Radiochemical Analysis Group (LLRA) of the Analytical Chemistry Division of ORNL: gamma spectral analysis, gross alpha, gross beta, total uranium, and strontium-90 (Tables 2 and 3). Samples were dried and ground before analyzing. The analyses performed by the LLRA were in accordance with the procedures provided in the Martin Marietta Energy Systems Environmental Analysis Manual (MMES 1988). It should be noted that chemical analyses were not performed during this survey.

6. As an addendum to the objectives of the original work plan, three vicinity properties adjoining CSX property near the switching yard were surveyed. These homesite surveys were prompted by the preliminary results from the track survey. At each homesite, a property drawing including all structures, estimated property lines, streets, concrete, and land marks was prepared. The property was then surveyed as described within Section 3 of the Procedures. All survey activities are outlined in the Pollutant Assessment Group Procedures Manual (Little et al. 1990).

4.0 RESULTS

4.1 Walkover surface gamma screening

The walkover gamma survey of the railroad tracks identified the regional gamma background range to be 5 to 9 μR/h at the ballast surface and 5.5 to 8 μR/h at one meter above the surface. Ten regions with elevated surface gamma readings ranging from 10 to 850 μR/h were located along the tracks and labeled A through J [Plate 1, (Figs. 1 and 4a)]. The 850 μR/h readings were determined to be isolated areas within these deposits. Regions A through I were located within the CSX switch yard along a railroad siding designated as Track B [Plate 1, (Fig. 4a)]. Region J [Plate 1, (Fig. 1)] was located near the beginning of the survey at placard 60,0. The deposits with elevated readings above background ranged from 1 m^2 to 58 m^2 in size. The surface and one meter gamma ranges for all deposits are listed in Table 1. Three additional areas with elevated gamma readings were located within the CSX property boundaries. Area 1 was located behind Quadrex Corporation's plant (a nuclear decontamination and waste processing plant located between placards 2000 and 2300 on the main track). The elevated readings from Area 1 were determined to be a gamma emanation field from radioactive waste stored on the Quadrex site [Plate 1, (Fig. 2)]. Area 2, a small igneous rock approximately 10 cm in diameter, was located at placard 3480,0 with a slightly elevated gamma exposure rate reading of 15 μR/h [Plate 1, (Fig. 3)]. This rock was not removed from the property. Area 3, the ballast between placards 4664 and 4750, had slightly elevated gamma readings of 9 to 13 μR/h. The elevated readings at Area 3 were determined to be inherent to the natural material within the fine crystallin dolomite [Plate 1, (Fig. 4)]. The elevated readings within these three areas were not a result of contaminated ballast.

Table 1. Compiled data from contaminated regions

REGION	TRACK DESIGNATION	LOCATION from 0,0 (meters)	GAMMA RATE RANGE uR/h		SIZE (m^2)	SOIL SAMPLE NUMBERS
			Surface	1 Meter		
A	B	72–74	13–215	7–45	2	N/A
B	B	80–81	10–18	7.0	2	N/A
C	B	82–85	10–215	7–46	5	N/A
D	B	90–91	10–82	7–24	3	3305
E	B	100–105	10–850	7–56	17	3304 3308 3309 3310 3311
F	B	109–111	10–108	7–29	3	N/A
G	B	115–124	10–850	7–75	58	3312 3313 3314
H	B	248–250	10–215	7–24	3	N/A
I	B	248–256	10–15	7–8	10	3306 3307
J	MAIN	60	13–26	7–7.5	<1	N/A

4.2 Radiological Analysis of Soil/Ballast Samples

Guided by the results of the walkover survey, sixteen, 600- to 800-g soil/ballast samples were collected from within the CSX property boundary. Two preliminary soil samples, numbers 3304 and 3305, were collected in March from the switch yard solely for screening purposes to determine the type of contaminant and future sampling rationale. These samples were not dried before analysis (as noted in Table 2) and results should be used only as a rough estimate of the actual dry weight activity. Five samples were collected from Region E, 3 from Region G, 2 from Region I, and 1 from Region D [Plate 1, (Fig. 4a)] and ranged in activity from 1.05 to 21,870 pCi/g of Cs-137. Four soil samples ranging from 0.49 to 1.3 pCi/g of Cs-137 were collected behind the Quadrex site to determine if the elevated gamma exposures were spillover contamination or a gamma emanation field produced by the radioactive waste storage (Table 2)[Plate 1, (Fig. 2)]. Because of the lack of elevated readings from the soil samples taken near Quadrex, contamination within the soil matrix is not probable. Therefore, the theory of an emanation field is founded. Soil samples 3306 through 3315 were analyzed for total uranium and strontium-90. These results were determined to be within the regional background range. All soil sample data are provided in Tables 2 and 3.

4.3 Vicinity Property Gamma Screening

Because the Cs-137 contamination located within the warehouse area of Oak Ridge is within close proximity to a residential area, DOE requested that three homesites with property lines adjoining CSX property be surveyed. No elevated readings above the regional background of 5 to 9 μR/h were located on any of the property sites. The results from these investigations are located in Appendix C.

Table 2. Results of gamma spectral analysis, concentrations are reported on a dry weight basis unless otherwise noted

SAMPLE IDENTIFICATION	LOCATION	DEPTH (cm)	Cs-137 CONCENTRATION pCi/g
3300[d]	QUADREX	0 – 2.5	1.3 ± 0.1
3301[d]	QUADREX	2.5 – 15	0.88 ± 0.05
3302[d]	QUADREX	0 – 2.5	1.1 ± 0.07
3303[d]	QUADREX	2.5 – 15	0.49 ± 0.05
3304[d]	E	0 – 15	>34000[b]
3305[d]	D	0 – 15	592
3306	I	0 – 15	29.7 ± 2.7
3307	I	0 – 15	37.8 ± 2.7
3308	E	0 – 15	21,870 ± 270
3309	E	15 – 30	9,720 ± 270
3310[a]	E	15 – 30	4,050 ± 270
3311	E	30 – 45	5,670 ± 270
3312	G	0 – 15	459 ± 27
3313	G	0 – 15	2,178 ± 27
3314	G	15 – 30	1,728 ± 27
3315	RANDOM	0 – 15	1.05 ± 0.16[c]

[a] Split sample of 3309.

[b] Exceeded the capacity of the counter (7.06 g = 95,000 pCi/g ± 250).

[c] Background concentrations of Cs-137 in soils in Oak Ridge, Tn. range from 0.1 to 2.0 pCi/g.

[d] Samples taken for screening purposes only, concentrations are in pCi/g wet weight.

Table 3. Results of radiological analysis, concentrations are reported on a dry weight basis unless otherwise noted

SAMPLE IDENTIFICATION	TOTAL URANIUM pCi/g	STRONTIUM-90 pCi/g	GROSS ALPHA pCi/g	GROSS BETA pCi/g
3306	0.945 ± .08	0.378 ± .54	5.67 ± 4.05	25.4 ± 7.56
3307	0.972 ± .16	0.027 ± .43	5.40 ± 4.05	37.8 ± 8.10
3308	0.756 ± .24	0.240 ± 1.08	11.0 ± 9.18	19,710 ± 270
3309	0.702 ± .14	0.920 ± .62	4.32 ± 3.78	11,340 ± 270
3310	0.540 ± .22	1.760 ± 1.24	1.62 ± 3.78	8,640 ± 270
3311	0.540 ± .22	0.760 ± 0.84	5.40 ± 4.86	8,100 ± 270
3312	0.648 ± .14	0.110 ± .54	2.70 ± 2.97	324 ± 27
3313	1.026 ± .22	<.35	6.48 ± 4.32	2,160 ± 54
3314	0.378 ± .11	0.46 ± .51	2.97 ± 3.24	1,944 ± 54
3315	0.549 ± .16	0.590 ± .62	8.64 ± 5.13	10.8 ± 6.48

5.0 CONCLUSIONS

A survey of the CSX Transportation Group railroad right-of-way, from 30 meters beyond the intersection of Bear Creek Road and Scarboro Road to Elza Gate in Oak Ridge, Tennessee, was performed by the Pollutant Assessment Group of Oak Ridge National Laboratory between March 6-13, 1990 and June 26-29, 1990. The survey revealed elevated gamma exposure rates above the regional background of 5 to 9 μR/h. The maximum direct gamma exposure rate at 1 m above the surface was determined to be 75 μR/h. Soil sample results indicated the presence of Cs-137 ranging in levels of 30 pCi/g to 21,870 pCi/g within the contaminated regions. Background Cs-137 levels from this and previous surveys appear to be 0.1 to 2 pCi/g (ORAU 1987). The contamination was primarily within the upper 45 cm of ballast or soil; with few exceptions, it was limited to the area within 2 m of the track centerline. Two regions of contamination, G and I, were predominantly within the low-lying area located between railroad sidings "B" and "C".

The Department of Energy (DOE) has not established a specific guideline for Cs-137 contamination in soils for unrestricted areas; however, the Nuclear Regulatory Commission (NRC) has used a guidance level of 17 pCi/g for sites being released from licensing controls (ORAU 1987). Based on an area of contamination of 104 m^2 and an average depth of 45 cm, the estimated volume of soil exceeding the NRC's 17 pCi/g guideline concentration for Cs-137 is 47 m^3.

No elevated gamma readings above the general background range were encountered during the vicinity property survey. However, there is a possibility of contaminant migration within the drainage pathways. Moreover, because of the difficulty in sampling the ballast material and the lack of chemical evaluations, the full extent of the contamination could not be delineated. Therefore, an RI/FS is recommended to assure appropriate remedial action and complete waste characterization.

6.0 REFERENCES

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Little, C. A., et al. 1990. "Pollutant Assessment Group, Procedures Manual (DRAFT)", Oak Ridge National Laboratory, Grand Junction, Colorado.

Martin Marietta Energy Systems, Inc. (MMES), 1988. Martin Marietta Energy Systems Environmental Analysis Manual, Oak Ridge Y-12 Plant (in revision).

ORAU, 1987. "Radiological Survey of the Railroad Tracks Adjacent to Scarboro Road, OakRidge, Tennessee." Oak Ridge Associated Universities, Oak Ridge, Tennessee.

APPENDIX A
WORK PLAN FOR CSX SURVEY

WORK PLAN FOR THE CHARACTERIZATION AND ASSESSMENT OF RADIOLOGICAL CONTAMINATION OF THE CSX TRANSPORTATION GROUP RAILROAD TRACKS

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March 1989

CONTENTS

Work Plan for the Characterization and Assessment of Radiological Contamination of the CSX Transportation Group Railroad Tracks

1.0 PURPOSE

The purpose of this work plan is to outline a program: (1) to locate and characterize radiological contamination along the CSX Transportation Group (CSX) railroad tracks in Oak Ridge; (2) to provide for the QA for the characterization study; and (3) to assess the risk to the public, railroad workers, and environment from the contamination.

The objectives of the characterization phase of the project are to:

- identify the presence of radiological contaminants in the ballast and soils below the ballast of the CSX Transportation Group railroad tracks northeast of the Y-12 Plant;
- delineate the horizontal and vertical extent of the radiological contamination along the tracks;
- characterize the types and levels of the contaminants;
- provide a data base to be used in the determination of compliance with state and federal regulations and in the assessment of risk associated with the contamination.

The objectives of the assessment phase of the project are to:

- review applicable or relevant and appropriate regulations to determine compliance with established limits or guidelines for radiological contamination;
- prepare a preliminary report for the Department of Energy (DOE) assessing the risk to the public, including railroad workers, based on existing data from previous surveys of the contamination;
- prepare a final assessment of the risk to the public from the contamination and recommend future actions based on data from the characterization study outlined in this work plan and data from previous studies.

Results of the characterization study and risk assessment will be included in a final report to the DOE presenting recommendations for future actions. An organizational chart for the project is given in Attachment 1.

2.0 BACKGROUND

A radiological and chemical surface characterization survey of the Y-12 Plant Site was conducted in early 1986 by the Radiological Survey Activities Group (RASA) in the Health and Safety Research Division (HASRD) of Oak Ridge National Laboratory (ORNL). During this survey, Cs-137 contamination was identified in several locations at the east end of the plant. Localized areas of contamination were found along both sets of the CSX Transportation Group railroad tracks west of Scarboro Road near the eastern perimeter of the Y-12 Plant. At the request of Y-12 management, a preliminary survey for radionuclide contamination was also

conducted by RASA personnel along the CSX railroad spur east of Scarboro Road across from the Y-12 Plant. Additional areas of contamination were located along this spur which is easily accessible to the public (Foley, 1986). To further delineate the extent, levels and types of radiological contamination in the areas east and west of Scarboro Road, a follow-up study was commissioned by the Department of Energy and conducted by the Radiological Site Assessment Group of Oak Ridge Associated Universities (ORAU) in November 1986 with a report issued to DOE in February 1987 (ORAU, 1987). The ORAU survey further delineated the areas and concentrations of Cs-137 contamination in the railroad ballast east and west of Scarboro Road and discounted the presence of other gamma-emitting radionuclides above background ranges. With only a few exceptions, elevated readings were within 1 m of the track centerline and were confined to the ballast above the soil.

Although the original source of the Cs-137 contamination is unknown and may never be known, it has been suggested that the contamination occurred during waste transfer operations during the period (1955-1963) when Oak Ridge National Laboratory was designated by the Atomic Energy Commission as a regional waste disposal site for radioactive wastes. During that period, most shipments of waste were transported by truck directly to ORNL, but some also came in by rail to Y-12 for eventual transfer by truck to the Solid Waste Storage Areas (SWSAs) at ORNL. It was suggested that contamination of the track area occurred during the off-loading of radioactive wastes from the railroad cars. This theory, however, is not supported by results from aerial radiological surveys of the Oak Ridge reservation conducted by EG&G Energy Measurements, Inc. in 1973, 1974 (Burson, 1976) and 1980 (Boyns, 1984). None of these surveys showed the presence of Cs-137 contamination in the vicinity of the CSX tracks at Y-12 suggesting that the contamination occurred sometime after the last aerial survey in 1980 and after ORNL served as a regional disposal site.

Since there is a great deal of uncertainty concerning the source and extent of the Cs-137 contamination, a more complete characterization of the contamination is required in order to determine the scope of needed remediation measures . For instance, a determination of the possible presence of radioactive contamination along the tracks beyond the immediate vicinity of the Y-12 Plant is needed. This work plan presents a survey and sampling plan designed to accomplish this. As mentioned above, data from the characterization study will be used in conjunction with data from the previous ORAU and ORNL surveys to determine whether or not there is compliance with federal and/or state regulations and to assess the magnitude and immediacy of risk from the contamination. Recommendations for future actions will be made based on these findings and included in the final report to DOE.

3.0 CHARACTERIZATION STUDY

3.1 Rationale

The strategy proposed for the characterization study for this project consists of two phases. The two-phased approach allows for modifications to be made to the second phase dependent upon the results from the first phase. Phase I will consist of a walk-over gamma exposure scan conducted by staff of the Pollutant Assessment Group in the Health and Safety Research Division (HASRD) of ORNL. Permission will be requested and received from CSX before beginning any survey work along the railroad's right-of-way. The Division Engineer for CSX will be notified a minimum of seventy-two hours before the commencement of any survey work.

The survey will originate at the track juncture approximately 30 meters north of the intersection of Bear Creek Road and Scarboro Road and proceed along the CSX tracks in a northeasterly direction away from the Y-12 Plant terminating at Elza Gate near the eastern edge of the town of Oak Ridge. Areas showing higher than background gamma readings will be flagged for possible later sampling. The contamination in the immediate vicinity of the Y-12 Plant has already been well characterized in the previously mentioned ORNL and ORAU reports and will not be re-surveyed.

If areas of significant contamination (greater than two times the normal background levels) are found during the Phase I walk-over gamma survey, a Phase II sampling program will be conducted to identify the radionuclides and to determine their concentrations. The Phase II program will consist of sampling surface and subsurface ballast at several of the identified hot spots as well as at a number of random locations. The number of samples collected will depend on the extent of contamination found.

3.2 Field and Laboratory Documentation

Field documentation for Phases I and II of the characterization study will be in accordance with the *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program,* ORNL/TM-8600 (RASA Procedures Manual) (Myrick et al., 1987), the *Radiological Survey Activities Uranium Mill Tailings Remedial Action Project (UMTRA) Procedures Manual,* ORNL/TM-9902 (UMTRA Procedures Manual) (Little et al., 1986), and the *Environmental Surveillance Procedures Quality Control Program* (QC Manual) (Kimbrough et al., 1988). To provide a permanent record of field operations, all field entries will be made into a controlled and protected Field Data Log Book. In the field log book will be recorded all data relevant to the survey and sampling proceedings including, but not limited to, personnel present, equipment used, unusual occurrences, significant problems or delays, and changes made in field equipment, procedures or personnel. Entries in the field log book will be the responsibility of one of the field crew members and will be checked and initialed by him at the end of the day's activities. Daily entries will be reviewed and signed by the survey team leader. When not in use, the log book will be kept by the survey team leader or his appointee in a secure area (locked and out of sight). Laboratory entries will be recorded in the Sample Preparation Log Book and the Sample Data Log Book maintained by the Measurement, Applications and Development Group (see Sect. 15, Myrick et al., 1987) or the Pollutant Assessment Group of HASRD.

Standard chain-of-custody forms (see Attachment 2) will be maintained for all samples collected.

3.3 Phase I - Gamma Exposure Rate Survey

Comprehensive descriptions of the survey methods, instrumentation and instrument calibration procedures to be used are available in the RASA Procedures Manual (Myrick et al., 1987) and the UMTRA Prodedures Manual (Little et al., 1986).

3.3.1 Survey Location

As discussed above, the walk-over gamma survey will begin along the railbed approximately 30 meters north of the intersection of Bear Creek Road and Scarboro Road at the split of the main railroad tracks into the two railroad spurs that terminate either east or west of Scarboro Road. This location will be designated Site 0 and used as the primary reference point for survey activities. Secondary reference points will be established and identified by their distance from point 0. The distance between the primary and secondary reference points will be measured by rolling a measuring wheel along one of the rails. Secondary reference points may be designated and marked after an arbitrarily established distance (e.g. 100 m) has been traversed or at an easily identified structure along the track. The survey will proceed along the main track in a northeasterly direction and terminate just before the tracks cross Oak Ridge Turnpike near Elza Gate at the eastern edge of the city of Oak Ridge. In addition to the main railbed, all accessible sidings, railroad spurs and identifiable abandoned railbeds between Site 0 and the terminus will be surveyed.

3.3.2 Gamma Survey Methodology

Exposure rate measurements will be made using a portable gamma scintillation meter. The instrument used will be a Victoreen portable ratemeter, Model 490 Thyac III with a 1¼ X 1½ in sodium iodide (thallium) probe. Since scintillation meter readings are in counts per minute (cpm), these readings will be converted to an exposure rate in microroentgens per hour (μR/h) by onsite cross calibration of a number of scintillation meter readings with a corresponding number of Pressurized Ionization Chamber (PIC) measurements. Laboratory and field calibration procedures and calibration documentation for the PIC and the gamma scintillation meter are given in sections 16.3, 20.9 and 20.10 of the RASA Procedures Manual and sections 9 and 11 of the UMTRA Procedures Manual. If radiation fields exceeding the range of the scintillation meter are encountered, direct exposure rate measurements will be made with the ionization survey meter.

Background exposure rates will be established using procedures outlined in the RASA Procedures Manual (Myrick et al., 1987). Scans of the railroad bed will be made while holding the detector near the railbed surface and walking back and forth across the railroad tracks. Scans will extend a minimum of one meter beyond the edge of the tracks. For each 50 meter length of track surveyed, an average observed detector response will be recorded on a standardized data form (see Attachment 3) in the Field Data Log Book. If areas of elevated activity (greater than twice normal background) are encountered, the location will be recorded (i.e., distance from the primary or a secondary reference point and distance and direction from the centerline of the track), the site flagged, and an exposure rate taken and recorded at the railbed surface and at one meter above the surface. All elevated readings will be entered on the standardized data forms.

3.4 Phase II - Sample Collection and Analysis

If areas of elevated radiation levels are located during the Phase I gamma survey, Phase II sampling will be conducted. Sample collection will be undertaken in accordance with

procedures outlined in more detail in the RASA Procedures Manual (Myrick, et al., 1987) and in the QC Manual (Kimbrough et al., 1988). No samples will be collected in the event that areas of elevated activity are not located.

3.4.1 Sample Locations

The exact locations and number of samples to be collected will be determined after the results of the Phase I gamma survey are known. If areas of radionuclide contamination are identified during the Phase I survey, a minimum of 20 biased or selective samples from sites of abnormally high radiation levels (i.e., greater than two times the normal background level) will be taken unless the small number of identified contaminated areas precludes this. In addition to the biased samples, approximately 10 to 20% of the total number of samples collected will be random samples. Once sample locations have been chosen based on the Phase I results, all sampling locations will be defined by their distance from primary or secondary reference points and the bearing and distance from the centerline of the track.

3.4.2 Sample Collection Methodology

Samples will be taken at different depths within the ballast using trowels, scoops or other appropriate equipment. An effort will be made to remove the largest pieces of rock from the ballast sample and concentrate on retaining the fine material. Each sample will consist of approximately 0.8 kg of material packaged in plastic bags for transfer to ORNL for processing. Bags will be labeled and sealed following chain-of-custody procedures. Each sample will be given an unique alphanumeric identification following guidelines given in Section 14 of the Procedures Manual (Myrick, et al., 1987). The format for the sample identification alphanumeric (SIA) will be established by the survey team leader (i.e., E. K. Roemer) and entered into the Field Data Log Book. As each sample is collected, the corresponding SIA will be entered into the Field Data Log Book and on chain-of-custody forms along with the site location, time and date of collection, and initials of sample collectors.

3.4.3 Sample Analysis

The following radiological analyses will be performed on the ballast samples in the laboratory: gamma spectral analysis, gross alpha, gross beta, total uranium and Sr-89/90. The Measurement, Applications, and Development Group or the Pollutant Assessment Group of HASRD will prepare the collected samples and perform the gamma spectral analysis using procedures documented in Sect. 15 of the RASA Procedures Manual (Myrick et al., 1987). Upon completion of the gamma spectral analysis, the samples will be sent (along with their appropriate chain-of-custody documentation) to the Low-level Radiochemical Analysis Group (LLRA) of the Analytical Chemistry Division of ORNL for determination of gross alpha, gross beta, total uranium, and Sr-89/90. Analyses performed by staff of LLRA will be in accordance with those provided in the *Martin Marietta Energy Systems Environmental Analysis Manual* (MMES 1988).

3.4.4 Chain-of-Custody Procedures

Chain-of-custody procedures, including the maintaining of chain-of-custody forms for all samples, will be followed throughout the sampling and analysis phase. These procedures, designed to ensure the integrity of samples from the time of their collection until their final disposition, are described in detail in the QC Manual (Kimbrough et al., 1988).

3.5 Personnel Safety and Protection

Before entry upon CSX property, the survey team will notify the Division Engineer for CSX and the Knoxville office of CSX at least seventy-two hours prior to entry and will abide by all instructions from CSX concerning the safety of the railroad or of the survey team entering CSX property. During the survey and sampling work, one member of the field survey crew will be designated as a look-out for the survey team. He will be posted along the tracks within voice distance of the field survey/sampling crew and will have the sole responsibility of monitoring and alerting, using a whistle or air horn, the field crew to any train movement along the tracks. If such movement represents a hazard to the field crew, survey/sampling activities will cease until the hazard has passed. The field crew will carry a two-way radio or cellular phone for contacting the ORNL shift supervisor in case of an emergency.

Procedures for personnel exposure monitoring and protection are outlined in Section 17.3 of the Procedures Manual (Myrick, 1987) and in the QC Manual (Kimbrough, 1988) and will be followed during the survey and sampling phases of the characterizaion study. As a minimum, field personnel will be required to wear steel-capped safety shoes and safety glasses. When collecting and handling samples, personnel will wear gloves to minimize the chance of personnel contamination and cross-contamination of samples. If there is a high probability of contaminating clothing during the field survey, field personnel will wear company-issued protective clothing or disposable anticontamination apparel. In addition to the measures taken above to ensure safety, a ESD Project Safety Summary will be completed and submitted for approval. (see Attachment 4 for ESD Project Safety Summary)

3.6 Waste Management

The survey and sampling phases of the characterization study are expected to generate little, if any, waste. In the event that reusable protective clothing (eg. coveralls, rubber boots) is worn during the survey work and has become contaminated, that clothing will be placed in a transparent plastic bag. The bag will be sealed with tape, checked by a health physicist (HP), tagged, and dropped off at the ORNL laundry for cleaning. Disposable protective clothing (eg. Tyvek coveralls, rubber gloves, shoe covers) and miscellaneous compactible trash that may have become contaminated, will be collected into the transparent, yellow plastic bags designated for low-level contaminated waste, checked by a HP, tagged, and properly disposed of as low-level compactible radioactive waste. Any non-contaminated trash that might be generated during the survey operations will be bagged separately and disposed of in the proper receptacles in the plant area.

3.7 Quality Assurance

Because of the limited scope of this project, a full-fledged NQA-1 plan will not be required. However, certain measures mentioned previously in the text of this document will be taken to ensure QA for this project. These measures include:

- a project organizational plan (see Attachment 1);
- maintenance of a protected Field Data Log Book for recording field entries (see Section 3.2 above);
- the use of documented calibration procedures for field survey equipment (see Section 3.3.2 above);
- the use of chain-of-custody procedures for all samples collected (see Sections 3.4.2 and 3.4.4 above);
- the use of documented procedures for sample analyses (see Section 3.4.3 above).

4.0 ASSESSMENT OF RISK

A report presenting a review of applicable or appropriate and relevant regulations and a preliminary assessment of radiation doses to the public resulting from the Cs-137 contamination will be prepared for DOE. This initial assessment will be completed before the characterization study is initiated and will be based primarily on data available in the ORAU survey (ORAU, 1987). After completion of the characterization study, a final assessment will be prepared incorporating the new data from the characterization study as well as data from existing reports. In order to refine the dose analysis to railroad workers, information concerning possible exposure times to railroad workers from routine as well as maintenance activities along the tracks will be sought from CSX and become part of a final assessment. The risk assessment and recommendations for accomplishing any needed remediation based on regulatory guidelines will be included in a final report to DOE.

5.0 APPROVALS

Project Manager _____ Date 31 Mar 89

QA Coordinator _____ Date 3/28/89

ESD Safety Officer _____ Date 3/29/89

Supervisor of
Waste Operations _____ Date 3/23/89

6.0 REFERENCES

Boyns, P. K., 1984. An Aerial Radiological Survey of the Oak Ridge Reservation, Oak Ridge, Tennessee (June 1980). Report No. EGG-10282-1001. Las Vegas, NV: EG&G/EM.

Burson, Z. G., 1976. Aerial Radiological Survey of ERDA'S Oak Ridge Facilities and Vicinity (Survey Period: 1973-1974). Report No. EGG-1183-1682. Las Vegas, NV: EG&G/EM.

Foley, R. D., 1986. "Cesium-137 Contamination," memorandum to G. E. Kamp (June 26).

Kimbrough, C. W., L. W. Long, and L. W. McMahon, 1988. Environmental Surveillance Procedures Quality Control Program, Martin Marietta Energy Systems, Inc., ESH/Sub/87-21706/1.

Little, C. A., B. A. Berven, T. E. Carter, M. L. Espegren, F. R. O'Donnell, S. J. Ramos, C. D. Retolaza, A. S. Rood, F. A. Santos, D. A. Witt, K. M. Woynowskie, 1986. Radiological Survey Activities - Uranium Mill Tailings Remedial Action Project (UMTRA) Procedures Manual, ORNL/TM-9902, Oak Ridge National Laboratory.

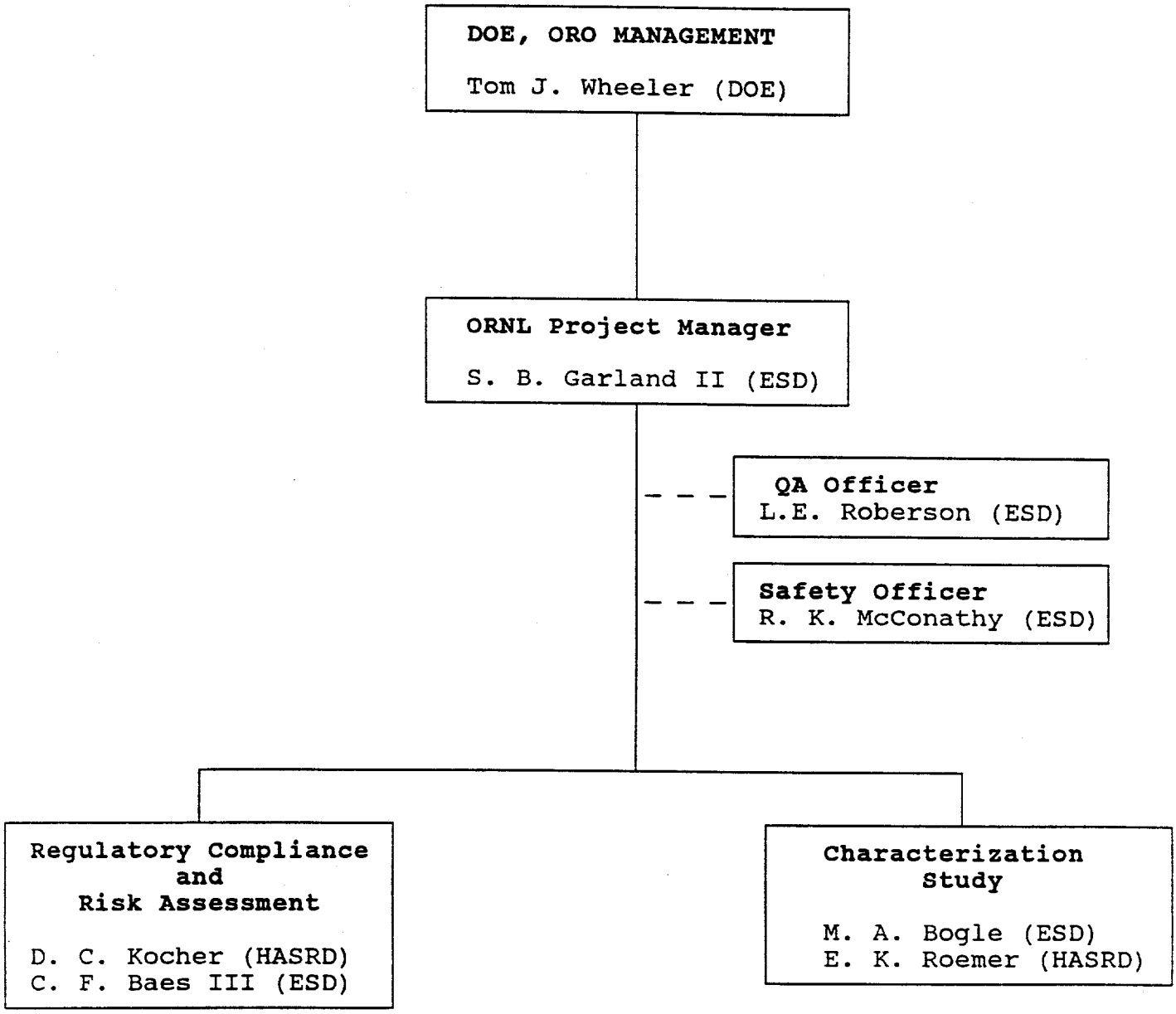
Martin Marietta Energy Systems, Inc. (MMES), 1988. Martin Marietta Energy Systems Environmental Analysis Manual, Oak Ridge Y-12 Plant (in revision).

Myrick, T. E., B. A. Berven, W. D. Cottrell, W. A. Goldsmith and F. F. Haywood, 1987. Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program, ORNL/TM-8600, Oak Ridge National Laboratory.

Oak Ridge Associated Universities (ORAU), 1987. "Radiological Survey of the Railroad Tracks Adjacent to Scarboro Road, Oak Ridge, Tennessee," letter report to the U. S. Department of Energy (February 10).

Attachment 1

ORGANIZATIONAL CHART FOR CSX RAILROAD TRACK PROJECT



ORNL/MAD CHAIN OF CUSTODY RECORD VERSION 1.3 PAGE _____ OF _____
OAK RIDGE NATIONAL LABORATORY. BLDG. 7503. M.S. 6382. P.O. BOX 2008
OAK RIDGE. TENNESSEE 37831-6382 TELEPHONE (615) 576-5212

SITE: _____ SAMPLE TYPE: _____ CONTAINER ID: _____

DATE SEALED: _____ SEAL TYPE: _____ SEAL NO: _____

SAMPLE ID	LOCATION	DATE/TIME	REMARKS

CARRIER: _____ WAYBILL NO: _____ DATE: _____

ORIGIN: _____ DESTINATION: _____

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1			
2			
3			
4			

Attachment

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

PAGE ____ OF ____

DATE: ____________

PROPERTY: ____________

INSTRUMENTS: ____________

SURVEYORS: ____________

GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM)		γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX. γ	GRID BLOCK MAX γ 10^3 CPM	β-γ CPM		SOIL SAMPLE NO.	REMARKS
	1 METER	SURFACE			1m / SURFACE	OPEN	CLOSED		

ATTACHMENT 4

MARTIN MARIETTA

Internal Correspondence

MARTIN MARIETTA ENERGY SYSTEMS, INC.

March 20, 1989

M. A. Bogle

Project Safety Summary Comments

Attached is an approved copy of ESD Project Safety Summary (PSS) #8903-02, titled " Characterization and assessment of radiological contamination of the CSX transportation group railroad tracks." Comments from C. H. Miller, Radiation Protection Department, about this work are given at the end of the comments section (#17) of this PSS. Please comply with Miller's requests, or contact him directly (4-6700) if you have questions.

Contact me if I can be of further assistance.

If the nature of the work changes to include hazards not mentioned on this form, please notify me so the existing form can be amended. Thanks for your cooperation.

Ron McConathy

R. K. McConathy, 1505, MS-6035, ORNL (4-7307)

Attachments

cc: S. E. Herbes

ENVIRONMENTAL SCIENCES DIVISION
PROJECT SAFETY SUMMARY

(See page 5 for instructions)

"Safety Summary" Form # 8903-02 Date Feb. 27, 1989

1. Responsible Staff Member: MaryAnna Boyle Phone: 4-7824

2. Title of Research: Characterization and Assessment of Radiological Contamination of the CSX Transportation Group Railroad Tracks
CSX Railroad Tracks

3. Location of work: Building _____ Room _____ Field Site in Oak Ridge

4. Starting Date: April, 1989 Estimated duration: 2½ - 3 weeks

5. Has a written description of this work been prepared? (YES) or NO. If YES, attach a copy. If NO give a brief description of the research.

(See attached work plan)

6. List hazardous chemicals (toxic, teratogens, carcinogens, etc.) and/or radioisotopes to be used. Include quantity, concentration, activity, and chemical form for each chemical/radioisotope as applicable. Also provide values for stock and diluted/working materials. (Continue as needed to #17)

Not Applicable

Hazardous Chemical/Isotope	Chemical Form	Concentration/ Activity	Quantity Used	MSDS Available?
				YES or NO
				YES or NO
				YES or NO
				YES or NO

7. List the name and badge number of personnel who will be involved in the use of the above chemicals and/or radioisotopes:

Not Applicable

8. Has an ESD Mini Waste Management Plan been prepared for this work? YES or (NO.) (If NO, see the ESD Environmental Protection Officer or Radiation Control Officer to obtain the form to fill out.)

Not applicable - See section on waste management in work plan.

(12/15/87)

15. List the isotopes to be used and fill in the requested information. (See the Health Physics Procedure Manual, Appendix A-7 (*) for help in filling in the requested information.) Not Applicable

Isotope	Radiotoxicity Class *	Radiation Quantity Handled (Ci)	Modifying Factor *	Lab. Type Required *

16. Is field work planned as a part of this project? (YES) or NO.

If YES, have all field work personnel read the "ESD Radio Use Procedure." Field personnel are from Health and Safety Research Division and will carry cellular phones. YES or NO. Not Applic

Will the field work be in radiation/contamination zones? Don't know but possibly. YES or NO.

If YES, have personnel been trained in the proper procedures for clearing through Health Physics after working in these areas? (YES) or NO.

If YES, are there pocket dosimeters available for use by each working group when required? (YES) or NO.

17. Continuations & comments:

The field work for this project involves a radiological survey of the CSX railroad tracks passing through Oak Ridge in order to identify any radioactive contamination along the track right-of-way. Samples will be collected for analysis if areas are located with radiation levels greater than twice the normal background level. It's entirely feasible that no contamination will be located along the stretch surveyed in which case no samples will be collected.

As mentioned in answer 10 above, the MAD group of HASRD (for DOE) have extensive experience in surveying radioactively contaminated sites and thus are very familiar with appropriate safety requirements, Section

APPENDIX B
FIELD DATA SHEETS FROM WALKOVER GAMMA SURVEY

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/7/90 INSTRUMENTS: 80, 74, S-7 SURVEYORS: EKR, MEM, SMF, DSL

PROPERTY: CSX R.R. MAIN LINE

RECROW

(J) *

GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
0,0	4	5	4-5	-	N/A	N/A	N/A	NONE BKGD
50,0	4	5	4-5	-	"	"	"	"
60Ø,0SE	4.5	22	10-22	R.R. TIE	"	"	"	SMALL AREA <1m² SEEMS TO BE R.R. TIE INVOLVEMENT.
100,0	3.5	4	3-4	-	"	"	"	NONE BKGD
150,0	3.5	4	3-4	-	"	"	"	"
200,0	4	4	3-4	-	"	"	"	"
250,0	3	4	3-4	-	"	"	"	"
300,0	4	4	3-4	-	"	"	"	"
350,0	3	3	3-4	-	"	"	"	"
400,0	3	3.5	3-4	-	"	"	"	"
450,0	3	4	3-4	-	"	"	"	"
500,0	3	4	3-4	-	"	"	"	"
550,0	3	4	3-4	-	"	"	"	"
600,0	3	4	2-4.5	-	"	"	"	"
700,0	2.5	4	2-4.5	-	"	"	"	"
800,0	2.5	4	2-4.5	-	"	"	"	"

* - ELEVATED REGIONS

INFO ON PLATE 1, FIG 1

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/7/90 INSTRUMENTS: 80, 74, S7 SURVEYORS: EKR, MEM, SMF, DSC

PROPERTY: CSX R.R. MAIN LINE

	GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	GRID POINT READINGS γ SCINT. (10^3 CPM) SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
	900,0	2.5	3	2-4.5	-	N/A	N/A	N/A	GENERAL BKGD
	1000,0	2.5	3	2-4.5	-	"	"	"	"
	1100,0	3	3	2-4.5	-	"	"	"	"
	1200,0	3	4	2-4.5	-	"	"	"	"
	1300,0	4	3	2-4.5	-	"	"	"	"
	1400,0	4	3	2-4.5	-	"	"	"	"
	1500,0	4	4	2-4.5	-	"	"	"	"
	1600,0	2.5	3	2-4.5	-	"	"	"	"
	1700,0	3	3	2-4.5	-	"	"	"	"
	1800,0	3	3	2-4.5	-	"	"	"	"
	1900,0	3	3	2-4.5	-	"	"	"	"
*	1900,4N	7.5	7.0	7-7.5	BRICKS	"	"	"	PILE OF BRICKS (EMANATION) ≠
*	2000,0	7.5	6.0	6-7.5	-	"	"	"	GAMMA INCREASES AS WE MOVE TOWARDS THE NORTH ≠
*	2000,6N	10.0	10.0	9-10.0	OFF BALAST	"	"	"	≠
*	2100,0	20.0	18.0	15-20	-	"	"	"	≠
*	2100,30N	30.0	30.0	25-30	NEXT TO FENCE	"	"	"	≠

≠ - THIS GENERAL REGION APPEARS TO BE EMINATION FROM THE "QUADREX" INC. TO THE NORTH OF THE TRACKS. MULTIPLE 55 gal DRUMS w/ RADIOACTIVE AND 2 MR/H LABELS.

* - ELEVATED REGIONS

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/7/90

INSTRUMENTS: 80, 74, 57

SURVEYORS: EKR, MEM, SMF, DSL

PROPERTY: CSX R.R. MAIN LINE

	GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	GRID POINT READINGS γ SCINT. (10^3 CPM) SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
* ‡	2200,0	55	45	45-55	ON BALAST	N/A	N/A	3300 3301	‡ SAMPLED @ ~2175, SN;
* ‡	2200,30N	100	100	100K	ALONG FENCE	"	"	3302 3304	NEXT TO THE QUADREX 2175, IN FENCE. TAKEN FOR SCREENING
* ‡	2300,0	22	20	18-22	ON BALAST	"	"		PURPOSES ONLY. NOT QUANTITATIVE
* ‡	2400,0	7	6	4-6	OK	"	"	NONE	GENERAL AREA)
	2500,0	5	5	4-5	"	"	"	"	"
	2600,0	5	5	4-5	"	"	"	"	"
	2700,0	4	5	4-5	"	"	"	"	"
	2800,0	4	4	4-5	"	"	"	"	"
	2900,0	3	4	4-5.5	"	"	"	"	"
	3000,0	4	4	4-6	"	"	"	"	"
	3100,0	4	5	4-6	"	"	"	"	"
	3200,0	4	6	4-6	"	"	"	"	"
	3300,0	4	5.5	4-5.5	"	"	"	"	"
	3400,0	3.5	5.5	4-5.5	"	"	"	"	"
	—			END OF	DAY		"	"	"

‡ - THIS GENERAL REGION APPEARS TO BE EMINATION FROM THE "QUADREX INC" TO NORTH OF THE TRACKS. MULTIPLE 55 gal DRUMS w/ RADIOACTIVE AND 2 mR/h SIGNS.

* - ELEVATED REGIONS

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/8/90 INSTRUMENTS: 80, 74, 57 SURVEYORS: EKR, MEM, DSL, SMF

PROPERTY: CSX RAILROAD MAINLINE

	GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	GRID POINT READINGS γ SCINT. (10^3 CPM) SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
	3400.0	3.5	4.0	3-5	-	N/A	N/A	N/A	IGNEOUS
*	3480,1E	3.5	12	12	ONE ROCK	"	"	"	RED ~~SCHIST~~ STONE - LEFT IN PLACE
	3500	3.0	5.0	3-5		"	"	"	GENERAL RIGO
	3600	3.0	5.0	3-6		"	"	"	"
	3700	3.0	6.0	3-6		"	"	"	"
	3800	4.0	5.5	3-6		"	"	"	"
	3900	4.0	6.0	3-6		"	"	"	"
	4000	4.0	6.0	3-6		"	"	"	"
	4100	3.0	6.0	3-6		"	"	"	"
	4200	3.0	6.0	3-6		"	"	"	"
	4300	3.5	6.0	3-6		"	"	"	"
	4400	3.5	5.5	3-6		"	"	"	"
	4500	4.0	5.5	3-6		"	"	"	"
	4600	4.0	5.5	3-6		"	"	"	"
* ‡	4664,2N	5.0	10	7-11	DIFFERENT ROCK TYPE	"	"		BALLAST OF A DIFFERENT TYPE! ~~IGNEOUS~~ STONES FROM 4664 - 4750
* ‡	4700.0	5.0	10	6-10	"	"	"		DOLOMITE

IDENTIFIED BY AS FINE CRYSTALINE DOLOMITE.

* - ELEVATED READINGS

‡ - BALLAST APPEARS TO BE DIFFERENT FROM PREVIOUS SURVEYS. ROCK LOOKS LIKE GREY ~~IGNEOUS~~ DOLOMITE STONES. AREA 4664 - 4750 ON SIDES OF TRACK ONLY - SEE MAP.

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/8/90

INSTRUMENTS: 80, 74, 57

SURVEYORS: EKR, MEM, DSC, SMF

PROPERTY: CSX RAILROAD MAIN LINE

	GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	GRID POINT READINGS γ SCINT. (10^3 CPM) SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX. γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
* ‡	4750, 2N	5	10	6-10	DIFFERENT ROCK TYPE	W/A	N/A	NONE	BALLAST OF A DIFFERENT TYPE. ROUNDED STONES FROM 4664-4785
	4800, 0	4.0	5.0	3-6	OK	"	"	"	DOLOMITIC ERA
				END OF DAY			"	"	

* - ELEVATED READINGS

‡ - SEE PAGE 1 OF 2

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/9/90 INSTRUMENTS: 80, 74, 57 SURVEYORS: EKR, MEM, SMF, DSL

PROPERTY: CSX R.R. MAIN LINE

GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
4800, 0	3	3.5	2.5-5.0	N/A	N/A	N/A	NONE	BKGD
4900, 0	3	3.5	2.5-5.0	"	"	"	"	"
5000, 0	3	4	2.5-5.0	"	"	"	"	"
5100, 0	3.5	4	2.5-5.0	"	"	"	"	"
5200, 0	3	4	2.5-5.0	"	"	"	"	"
5300, 0	3	3.5	2.5-5.0	"	"	"	"	"
5400, 0	2.5	3.5	2.5-5.0	"	"	"	"	"
5500, 0	2.5	3.5	2.5-5.0	"	"	"	"	"
5600, 0	3	4	2.5-5.0	"	"	"	"	"
5700, 0	3	4	2.5-5.0	"	"	"	"	"
5800, 0	3	4	2.5-5.0	"	"	"	"	"
5900, 0	3	4	2.5-5.0	"	"	"	"	"
6000, 0	3.5	4.5	2.5-5.0	"	"	"	"	"
6100, 0	3	4.0	2.5-5.0	"	"	"	"	"
6200, 0	3	4.0	2.5-5.0	"	"	"	"	"
6300, 0	3	4.0	2.5-5.0	"	"	"	"	"

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/9/90

PROPERTY: CSX R.R. MAIN LINE

INSTRUMENTS: 80, 74, 57

SURVEYORS: EKR, MEM, SME, DJC

GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	GRID POINT READINGS γ SCINT. (10^3 CPM) SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
6400.0	3	3.5	2.5-5.0	N/A	N/A	N/A	NONE	GENERAL BKGD
6500.0	2.5	3.0	2.5-5.0	"	"	"	"	"
6600.0	2.5	3	2.5-5.0	"	"	"	"	"
6700.0	3	4	2.5-5.0	"	"	"	"	"
6800.0	3	4	2.5-5.0	"	"	"	"	"
6900.0	3	4	2.5-5.0	"	"	"	"	"
6931.0	3.5	4	2.5-5.0	"	"	"	"	"
(Track intersection to main line @				ELEV Gate		"	"	End of official survey
100.0 R	3	3.5	2.5-5.0	"	"	"	"	Surveyed 100 meters on each
100.0 L	3	3.5	2.5-5.0	"	"	"	"	leg of γ to main ~~track~~ track *
				EKR 3/9/90				

* Main CSX line
surveyed 100 m on each leg
End of Survey
ATTACH

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/9/90

INSTRUMENTS: 80, 74, 57

SURVEYORS: EKR, MEM, SME, DSL

PROPERTY: CSX R.R. Siding A

GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	GRID POINT READINGS γ SCINT. (10^3 CPM) SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
0,0	2.5	3.5	2.5-5.0	N/A	N/A	N/A	N/A	BEM ZKeD
100,0	2.5	3	2.5-5.0	"	"	"	"	"
200,0	3	2.5	2.5-5.0	"	"	"	"	"
300,0	3	3.5	2.5-5.0	"	"	"	"	"
400,0	3	3.5	2.5-5.0	"	"	"	"	"
500,0	3	3	2.5-5.0	"	"	"	"	"
600,0	2.5	3.5	2.5-5.0	"	"	"	"	"
700,0	2.5	4	2.5-5.0	"	"	"	"	"
800,0	3	4	2.5-5.0	"	"	"	"	End of Siding A where track intersects main line
			EKM 3/9/90					

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 6/26/90 INSTRUMENTS: 13Z SURVEYORS: EKR DJT SMF

PROPERTY: CSX R.R. SIDING "B"

REGIONS	GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
	0, 0	4	5	4-5			N/A	N/A	BKGD
	50, 0	4	4	4-6			N/A	N/A	BKGD
A	72-74, 0-1	40	200	10-200	R.R. BALLAST		N/A	N/A	2 m²
B	80-81, 0-1N	4	15	7-15			N/A	N/A	2 m²
C	82-85, 2S	41	200	7-200			N/A	N/A	5 m²
D	90-91, 0	20	75	7-75			N/A	3305	3 m²
E	100-105, 2N	50	800	7-800			N/A	3308/3311 3309 3310	17 m²
F	109-111, 0	25	100	7-100			N/A	N/A	3 m²
HOT G	115, 124 SPN	68	800	7-800			OPEN 1.7 mR	3312 3313/3314	59 m²
	150, 0	4	5	4-6			N/A	N/A	BKGD
	200, 0	4	5.5	4-6			N/A	N/A	BKGD
H	248-250, 0	20	200	7-200			N/A	N/A	3 m²
I	248-256, 5N	5	12	7-12			N/A	B06 3307	16 m²
	300, 0	4	6	4-6			N/A	N/A	BKGD
	350, 0	5	6	4-6			N/A	N/A	BKGD
	400, 0	5	6	4-6			N/A	N/A	BKGD

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 6/26/90 INSTRUMENTS: 132

PROPERTY: CSX R.R. SIDING "B"

SURVEYORS: EKR DJT SMF

GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	GRID POINT READINGS γ SCINT. (10^3 CPM) SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
450, 0	5	5	4-6	N/A	N/A / "	N/A	N/A	GENERAL BKGD
500, 0	4	6	4-6	"	" /	"	"	
550, 0	4	6	4-6	"	" /	"	"	
600, 0	5	6	4-6	"	" /	"	"	
650, 0	5	6	4-6	"	" /	"	"	
700, 0	6	6	4-6	"	" /	"	"	
750, 0	6	6	4-6	"	" /	"	"	
				END				

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/9/90

PROPERTY: CSX R.R. Siding C

INSTRUMENTS: 80, 34, 57

SURVEYORS: EKR, MEM, SMF, DSL

GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
0,0	2.5	3.5	2.5-5.0	N/A	N/A	N/A	NONE	GENERAL BKGD
100,0	3	3.5	2.5-5.0	"	"	"	"	"
200,0	3	4.0	2.5-5.0	"	"	"	"	"
300,0	3	3.5	2.5-5.0	"	"	"	"	"
400,0	2.5	3	2.5-5.0	"	"	"	"	"
500,0	3	3	2.5-5.0	"	"	"	"	"
600,0	3	3.5	2.5-5.0	"	"	"	"	"
700,0	3	3.5	2.5-5.0	"	"	"	"	"
761,0	2.5	3	2.5-5.0	"	"	"	"	Intersection of siding C & Main track
			EKR 3/9/90					

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/12/90

INSTRUMENTS: 57, 42, 80

SURVEYORS: ~~AEE~~ EKR, MEM, SMF, DSL

PROPERTY: CSX R.R Siding D

GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	GRID POINT READINGS γ SCINT. (10^3 CPM) SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
0, 0	3.5	4	1.5-6	Low BKGD	N/A	N/A	NONE	Wide variation is Bkgd
100, 0	3	3.5	1.5-6	"	"	"	"	readings caused by variations
200, 0	3	3.5	1.5-6	"	"	"	"	in ballast rock types
300, 0	2.5	3	1.5-6	"	"	"	"	varying from met-ig-carb
400, 0	3	3.5	1.5-6	"	"	"	"	rock MEM
500, 0	3	3.5	1.5-6	"	"	"	"	
600, 0	3	3.5	1.5-6	"	"	"	"	Low BKGD - EKR
700, 0	3	4	1.5-6	"	"	"	"	"
800, 0	3.5	4	1.5-6	"	"	"	"	"
900, 0	3.5	4	1.5-6	"	"	"	"	"
1000, 0	4	4.5	1.5-6	"	"	"	"	"
1100, 0	4	5.5	1.5-6	"	"	"	"	"
1200, 0	4	6	1.5-6	"	"	"	"	"
1300, 0	1.5	2.0	1.5-6	"	"	"	"	Approx location of ballast
1400, 0	1.5	2.0	1.5-6	"	"	"	"	change, have red BKgd readings
1500, 0	1.5	2.0	1.5-6	"	"	"	"	then reading back to higher readings in the met. ballast.

OFFSITE MEASUREMENTS, OAK RIDGE NATIONAL LABORATORY

OUTDOOR DATA SHEET

DATE: 3/12/90 INSTRUMENTS: 57, 42, 80 SURVEYORS: EKR, MFM, SMF, DSE

PROPERTY: CSX R.R Siding D

GRID POINT or BLOCK (CIRCLE ONE)	GRID POINT READINGS γ SCINT. (10^3 CPM) 1 METER	GRID POINT READINGS γ SCINT. (10^3 CPM) SURFACE	γ - SCAN RANGE (10^3 CPM)	ANOMALIES W/LOCATION of MAX γ	GRID BLOCK MAX γ 10^3 CPM 1m / SURFACE	β-γ CPM OPEN / CLOSED	SOIL SAMPLE NO.	REMARKS
1600.0	2.0	3.0	1.5-6	low BKGD	n/a	n/a	NONE	low BKGD See SHEET 1.
1635.0	3.5	4.0	1.5-6	"	"	"	"	End of Siding D
			EKR					
			3/12/90					

APPENDIX C
RESULTS OF VICINITY PROPERTY SURVEYS

OAK RIDGE NATIONAL LABORATORY
OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

GRAND JUNCTION OFFICE
P. O. BOX 2567
GRAND JUNCTION, COLORADO 81502

August 6, 1990

Mr. Tom J. Wheeler
U. S. Department of Energy
Environmental Restoration Division
P.O. Box 2001
Oak Ridge, Tennessee 37831-8541

Dear Mr. Wheeler

Location Number:	OR00003
Location Address:	131 Claremont Road
	Oak Ridge, Tn. 37830
Date of Issue:	July 17, 1990
Survey Date:	June 27, 1990
Team Leader:	E.K. Roemer

ORNL/GJ EXCLUSION REPORT
Health and Safety Research Division
Work performed as part of the CSX Railroad Survey

This radiological survey assessment was conducted using methods as defined in the (DRAFT) POLLUTANT ASSESSMENTS GROUP PROCEDURES MANUAL. A complete gamma screening revealed no elevated reading above the general background. This property is recommended for exclusion from further consideration by the CSX project based on exposure rates promulgated in DOE Order 5400.5.

Supporting graphics are attached. Data are as follows:

-Owner Information-
Owner Name(s): Mr./Mrs. Randy L. Gardner
Owner Address: 131 Claremont Rd.
Oak Ridge, Tn. 37830

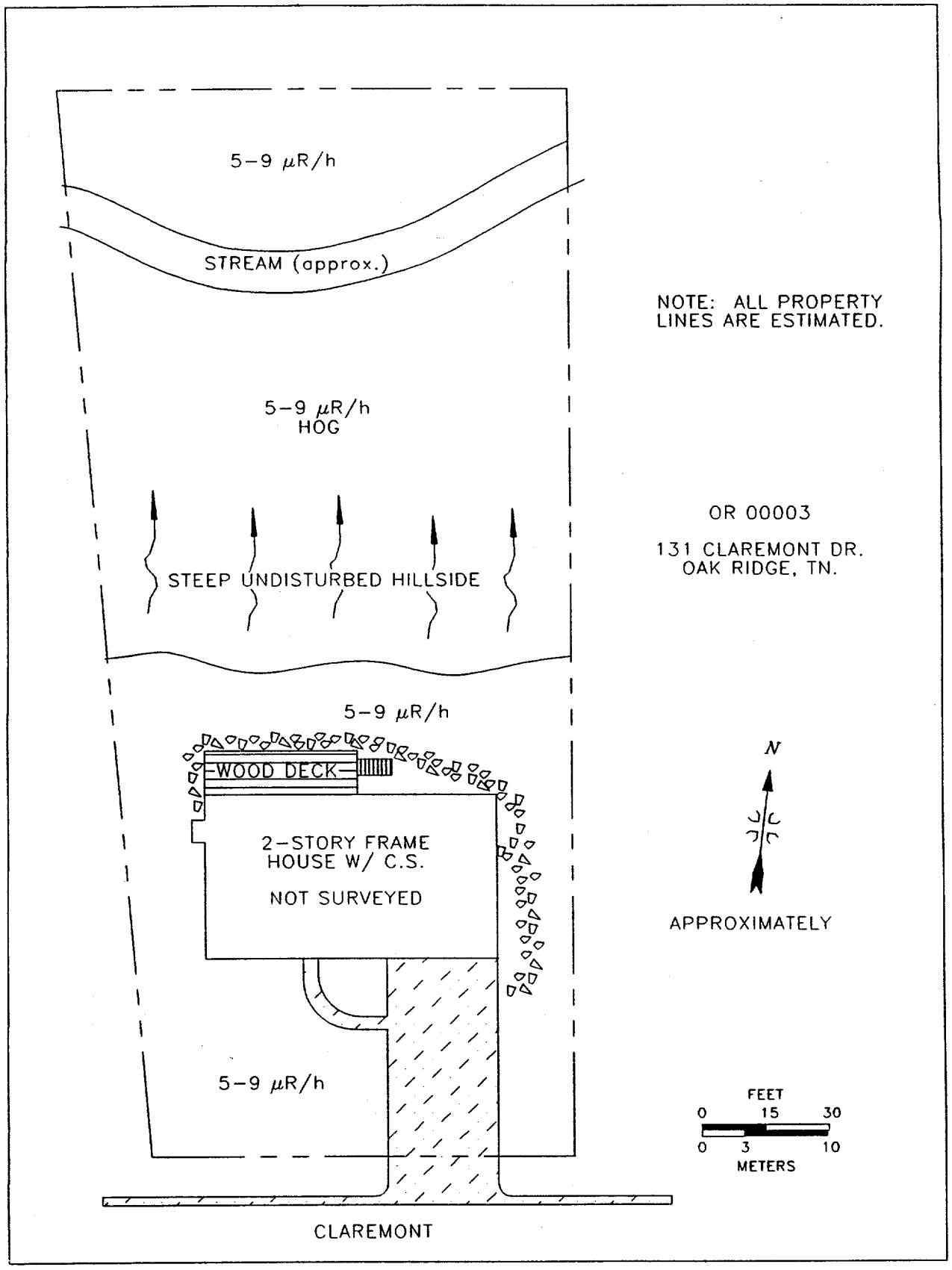
-Outdoor Screening Data-

Exposure Rate Range(s):	5-9 uR/h
Background Exposure Rate:	5-10 uR/h
High Outdoor Gamma (HOG):	9.0 uR/h
Point Source (*):	None uR/h

Comments: The scanning coverage was limited in areas of steep hillside and dense vegetation.

Sincerely,

Douglas K. Halford
Radiation Projects Manager



EKR 6/27/90 EKR 7/9/90

OAK RIDGE NATIONAL LABORATORY
OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

GRAND JUNCTION OFFICE
P. O. BOX 2567
GRAND JUNCTION, COLORADO 81502

August 6, 1990

Mr. Tom J. Wheeler
U. S. Department of Energy
Environmental Restoration Division
P.O. Box 2001
Oak Ridge, Tennessee 37831-8541

Dear Mr. Wheeler

Location Number:	OR00001
Location Address:	137 Claremont Road
	Oak Ridge, Tn. 37830
Date of Issue:	July 17, 1990
Survey Date:	June 27, 1990
Team Leader:	E.K. Roemer

ORNL/GJ EXCLUSION REPORT
Health and Safety Research Division
Work performed as part of the CSX Railroad Survey

This radiological survey assessment was conducted using methods as defined in the (DRAFT) POLLUTANT ASSESSMENTS GROUP PROCEDURES MANUAL. A complete gamma screening revealed no elevated reading above the general background. This property is recommended for exclusion from further consideration by the CSX project based on exposure rates promulgated in DOE Order 5400.5.

Supporting graphics are attached. Data are as follows:

-Owner Information-
Owner Name(s): Mr./Mrs. Larry Keane
Owner Address: 137 Claremont Rd.
Oak Ridge, Tn. 37830

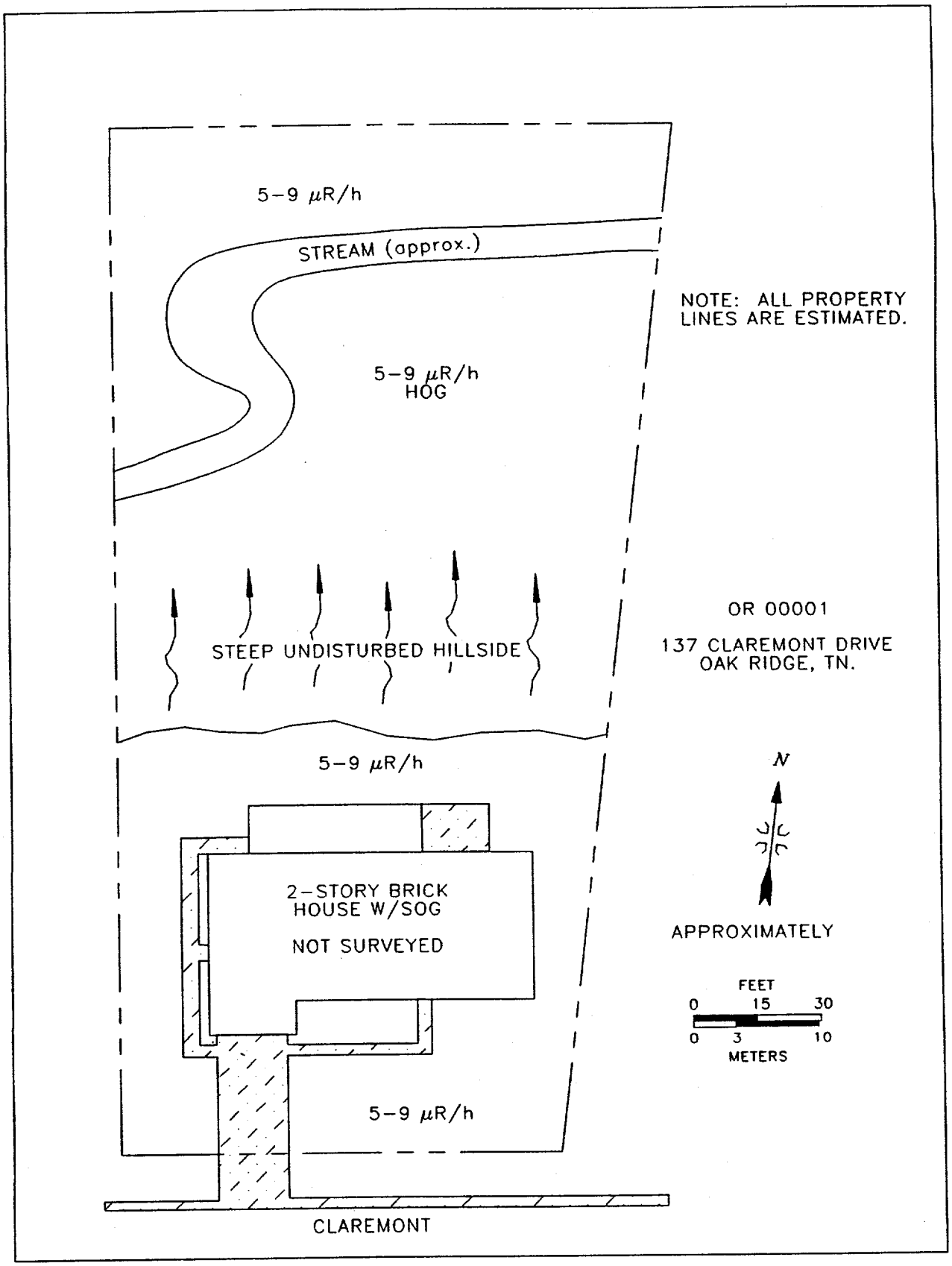
-Outdoor Screening Data-

Exposure Rate Range(s):	5-9 uR/h
Background Exposure Rate:	5-10 uR/h
High Outdoor Gamma (HOG):	9.0 uR/h
Point Source (*):	None uR/h

Comments: The scanning coverage was limited in areas of steep hillside and dense vegetation.

Sincerely,

Douglas K. Halford
Radiation Projects Manager



EKR 6/27/90 EKR 7/9/90

OAK RIDGE NATIONAL LABORATORY
OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

GRAND JUNCTION OFFICE
P. O. BOX 2567
GRAND JUNCTION, COLORADO 81502

August 6, 1990

Mr. Tom J. Wheeler
U. S. Department of Energy
Environmental Restoration Division
P.O. Box 2001
Oak Ridge, Tennessee 37831-8541

Dear Mr. Wheeler

Location Number:	OR00002
Location Address:	133 Claremont Road
	Oak Ridge, Tn. 37830
Date of Issue:	July 17, 1990
Survey Date:	June 27, 1990
Team Leader:	E.K. Roemer

ORNL/GJ EXCLUSION REPORT
Health and Safety Research Division
Work performed as part of the CSX Railroad Survey

This radiological survey assessment was conducted using methods as defined in the (DRAFT) POLLUTANT ASSESSMENTS GROUP PROCEDURES MANUAL. A complete gamma screening revealed no elevated reading above the general background. This property is recommended for exclusion from further consideration by the CSX project based on exposure rates promulgated in DOE Order 5400.5.

Supporting graphics are attached. Data are as follows:

-Owner Information-
Owner Name(s): Mr./Mrs. Maurice R. Richardson
Owner Address: 133 Claremont Rd.
Oak Ridge, Tn. 37830

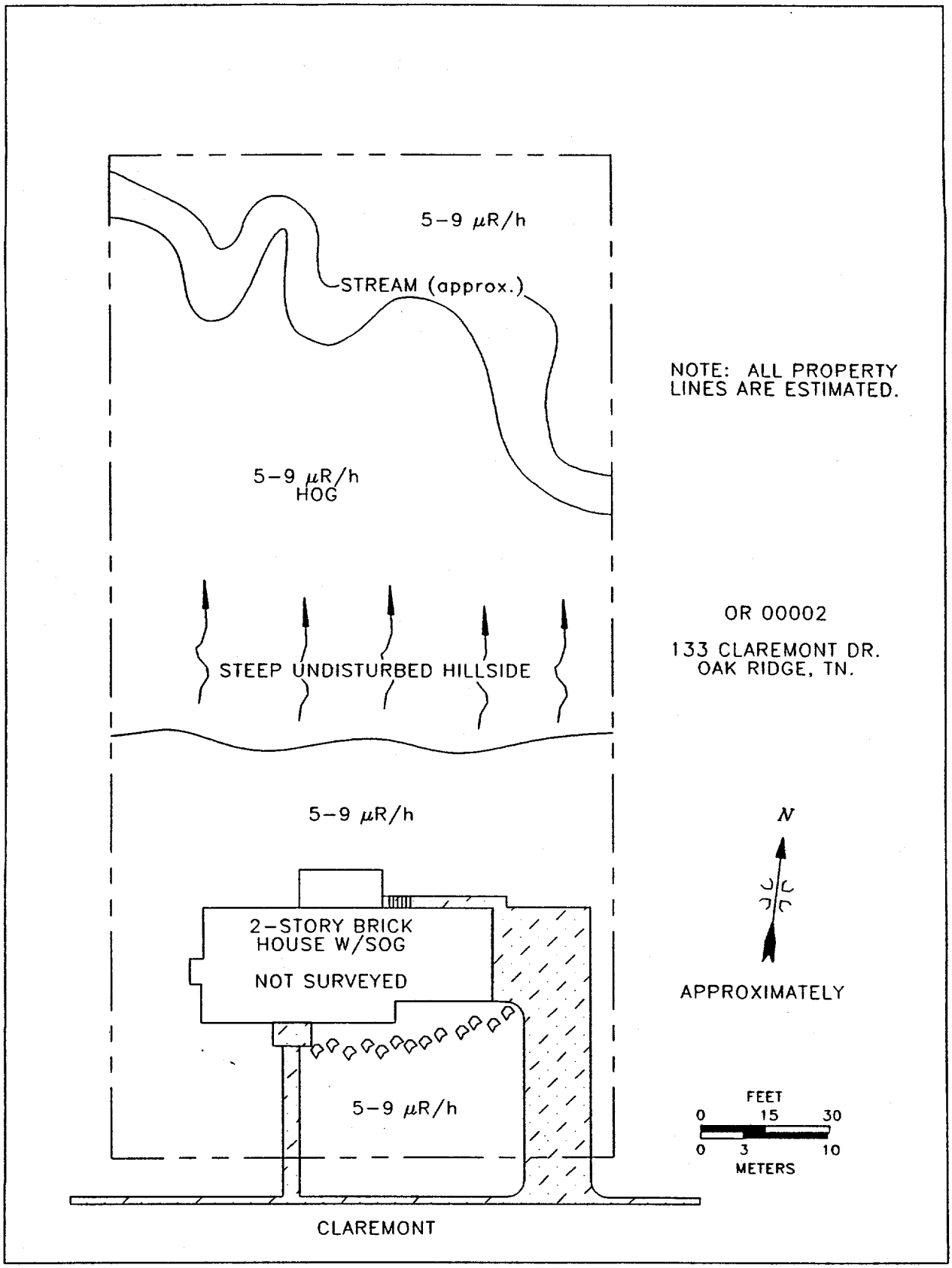
-Outdoor Screening Data-

Exposure Rate Range(s):	5-9 uR/h
Background Exposure Rate:	5-10 uR/h
High Outdoor Gamma (HOG):	9.0 uR/h
Point Source (*):	None uR/h

Comments: The scanning coverage was limited in areas of steep hillside and dense vegetation.

Sincerely,

Douglas K. Halford
Radiation Projects Manager



EKR 6/27/90 EKR 7/9/90